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Visual Acuity Outcome in Diabetic Retinopathy after Diode Laser Therapy

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background and Objective: Diabetic retinopathy as an important complication of diabetic mellitus is a common cause of blindness in diabetic people. The purpose of this study is to investigate the efficacy of the diode laser on visual acuity in patients with diabetic retinopathy.
Methods and Materials: In this cross-sectional study, patients with diabetic retinopathy who had clinically significant macular edema were candidates for laser therapy. High-risk diabetic patients with retinopathy that had also clinically significant macular edema were treated by a diode laser with wavelength of 810 nm. The visual acuity was evaluated 3, 6 and 12 months after the intervention and compared with the patient data before intervention. The data were collected with SPSS-15 and the distribution of descriptive data was indeed analyzed by the use of non-parametric test. Furthermore Wilcoxon and Mann-Whitney compared the mean log MAR before and after laser photocoagulation on visual acuity.

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Results: This study was done on 50 patients (64 eyes) with diabetic retinopathy. Twenty seven (54%) of patients were males and 23 (46%) were females. The results of this trial showed clinically significant improvement on visual acuity from 1.21 log MAR before laser therapy to 0.83 log MAR 3 months after intervention ($p = 0.02$). But this improvement was halted after 12 months of intervention and this does not show any statistically significant relation ($p = 0.07$). Moreover, the different levels of visual acuity before intervention and at 12 months after, showed no significant relation to gender (P=0.23).

Conclusion: According to these results, the patients' visual acuity recover at 3 and 6 months after intervention but it did not show any significant difference 12 months later. Retinal photocoagulations in patients with diabetic retinopathy have not led to a worsening of patients' visual acuity in the long run.

Keywords: Diabetic retinopathy; visual acuity; laser therapy.

1. INTRODUCTION

The high prevalence of diabetes accordingly had increases its complications which will in turn damage the vascular system. This effect increases mortality and morbidity in diabetic patients. One of the vascular complications of diabetes is retinopathy, which is one of the most serious health hazards. But the developments of diabetic control over the last years have reduced the risk of blindness in diabetic patients. However, the higher prevalence of diabetes has remained as a major problem in diabetic retinopathy [1,2].

Diabetes is the leading cause of blindness in those patients aged 20 to 74 years. The risk of blindness in diabetics is 25 times greater than other people [3]. Blindness primarily occurs as a result of advanced diabetic retinopathy due to clinically significant macular edema. The proliferative diabetic retinopathy appeared in more than 50% of patients with type 1 and more than 10% of type 2 patients who had a 15 years history of diabetes [1,3,4].

Diabetic retinopathy is divided into two stages. The non proliferative diabetic retinopathy is the early stage and proliferative diabetic retinopathy is the advanced stage. Non proliferative diabetic retinopathy usually appeared in the late first decade or early second decade of diabetes. The more severe non-proliferative stage had an increasing chance being converted to proliferative stage within a 5 year period [2]. This is an opportunity to provide early detection and treatment of retinopathy.

Diabetic retinopathy is the most common chronic complication of diabetes. This complication is the utmost importance because it is the most destructive complication and the most common cause of blindness in those aged 25-74 years in America [3]. Chronic hyperglycemia leads to increased secretion of vascular endothelial growth factor (VEGF) which changes the resistance of tight junctions bet*w*een cells and ultimately causes vascular leakage and leads to creation of new blood vessels in the retina [2]. Today, with improvements in quality of health care, the chronic diseases such as diabetes mellitus and its complications have become one of the most important public health problems [1].

Laser photocoagulation is recognized as one of known treatments of diabetic retinopathy. Laser treatment has been found to reduce abnormal blood vessels in diabetic retinopathy. It is thought that the destruction of the peripheral parts of the retina by laser treatment reduces angiogenesis factors generated from the ischemic retina. So, the macula is protected from damage found in proliferative diabetic retinopathy stage [5]. Retinal photocoagulation proposed over 50 years ago by Meyer-Schwickerath which was the first functional laser built in 1960 [6]. Current therapies such as steroids and anti-neo-angiogenesis compounds (Anti-vascular endothelial growth factors) have a temporary effect and require repeated injection into the vitreous fluid. The retinal photocoagulation continued to progress in 50% of patients with retinopathy despite retinal photocoagulation but its effect prevented the drastic reduction of visual acuity [7].

Because of the high prevalence of diabetes in some society [8,9], retinopathy has a major effect on quality of life in diabetic patients, especially when visual acuity is less than 1/10 on the Snellen chart. Therefore, this study was conducted to determine the effect of diode laser

treatment on visual acuity in patients with diabetic retinopathy and clinically significant macular edema.

2. METHODS

In this cross-sectional study fifty cases of diabetes who needed laser photocoagulation were enrolled. The patients underwent complete eye examination and those who had high-risk proliferative retinopathy with clinically significant macular edema were treated by diode laser with a wavelength of 810 nm. Laser photocoagulation was done in focal or diffused pattern around the macula or directly on micro-aneurysms (The minimum distance from the macula was 500 µm), the number of points in each session ranged from 70-280, and the size of the laser spot was 50-100 µm. Pan-retinal photocoagulation also had the same wavelength of 810 nm, the spot size were between 300-500 µm and the applied laser points were about 400-300 spots. Patients follow-up periods were 3, 6, and 12 months after laser treatment and re-examination included inspection of visual acuity by Snellen's chart which was converted to log MAR. Visual improvement defines the reduction of Log MAR. The patients with previous intraocular surgery or eye trauma which interfere visual acuity were excluded from the study. The data collected in questionnaire was analysed using software SPSS 15 and distribution of descriptive data was explained. Because of absence of normal data distribution, to compare the mean Log MAR visual acuity before laser treatment to Log MAR visual acuity after laser photocoagulation, the Wilcoxon test was used. To compare the two groups, the Mann-Withney test was used to compare the average visual acuity levels after laser therapy during 3, 6 and 12 months of analysis with repeated variance at the $\alpha \leq 0.05$.

The institution consent for the study was got from-ethic comity and also all the patients gave their informed consent for the study.

3. RESULTS

In this study, 50 patients (64 eye) were enrolled, of which 27 (54%) were males and 23 (46%) were females. The average age of patients was 61±9.7 years. In Table 1, the frequency of patients on the basis of sex and changes in Visual acuity before and after laser therapy are presented. In this comparison, as shown in Table 1, the difference of visual acuity before and after 12 months of intervention, increased in men and decreased in women, but this difference was not significant.

In comparison to the other depending variables, the amount of Visual acuity levels in the patients before the laser treatment was 1.21 Log MAR (20/320 Snellen) and, three months after intervention a recovery of Visual acuity level to 0.83 Log MAR (20/135 snellen) with $p = 0.02$ was observed. The visual acuity after six months reached to 0.92 Log MAR (20/166 snellen) and in the final follow up after 12 months, it was 1.27 log MAR (Fig. 1) which was not statistically different ($p = 0.11$).

The survey showed (Fig. 1) that despite the improvement in Visual acuity before and after the laser treatment, the long time differences were not statistically significant. The survey was conducted by using repeating ANOVA tests. ($P = 0.11$).

4. DISCUSSION AND CONCLUSIONS

In this study, the Visual acuity of patients with diabetic retinopathy, compared to baseline, after 3 months and 6 months of laser treatment increased. In a study conducted by Lima and his colleagues, Visual acuity of 48% of patients with diabetic retinopathy after 3 weeks of laser photocoagulation improved [10]. Another review by Solaiman KA and his colleagues showed that visual acuity of patients with diabetic retinopathy after 6 months of laser therapy or after the intravitreal injections, or both regimes was improved. But, only in groups who had received combined treatments or only intravitreal injections, a statistically significant difference was observed [11].

In these three groups study [11] of Soliman and his colleagues the reduced Visual acuity after the intervention of laser photocoagulation could possibly be traced to differences of laser photocoagulation or lack of controlling the blood glucose, lipid and blood pressure. The other explanation about such conditions may be the occurrence of advanced stage of retinopathy and that the laser treatment alone has had no impact on improvement of visual acuity. Therefore, the above factors probably cause exacerbation of retinopathy symptoms.

In a similar survey by the Jain and colleagues on diabetic macular edema, the visual acuity of patients from 20/45 before retinal photocoagulation with short pulse laser, reached

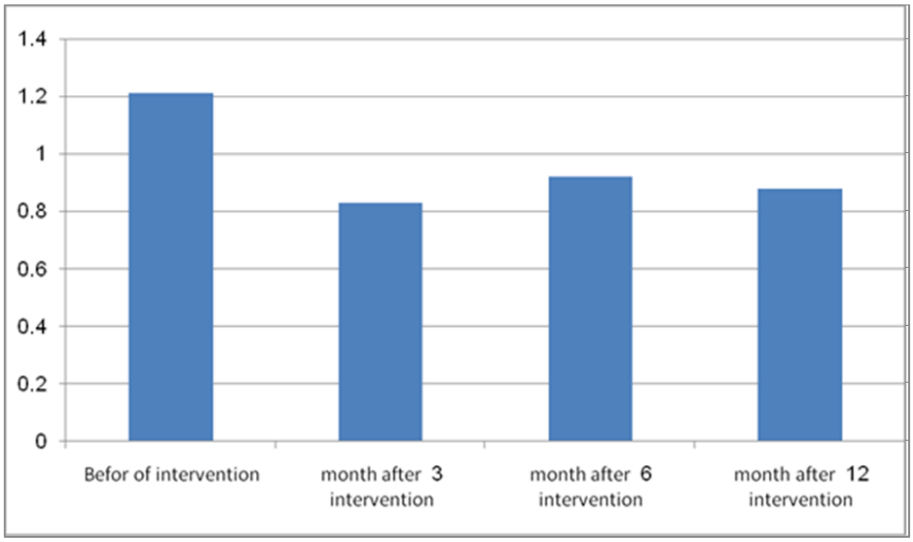

Fig. 1. Comparative study of visual acuity before and after retinal photocoagulation

Table 1. Distribution of patients according to their genders and visual acuity levels before and after laser photocoagulation

Variable	No	Mean visual acuity (log MAR) ± SD	Mann-withney test Wilcoxon test
Male	34	0.15±0.54	Z=1.25 P= 0.23
Female	30	- 0.34±0.82	
Visual acuity after 3 months	25	0.85±0.77	Z=2.34 P=0.02
Visual acuity after 12 months	25	1.27±0.86	Z=1.63 P=0.11

20/40 after 4 months, which was statistically significant [12]. Shimura and his colleagues found that visual acuity of 43% of diabetic patients with macular edema after 6 months of intervention had improvement [13].

In studies evaluating the therapeutic methods in diabetic retinopathy for systematic meta-analysis, the use of steroid injections and Anti-VEGF in the liquid inside the vitreous showed that only a small group using these remedies obtained good vision and therefore, it will be necessary to investigate new therapies as part of the priorities of the therapy in diabetic retinopathy [14,7].

In another study by Shrestha and his colleagues, it was claimed that in less developed countries, laser therapy is now more available and it is the preferred treatment [15]. This study results was similar to this report, but current therapies including laser photocoagulation and intravitreal injection therapy have their own treatment restrictions. Therefore, according to this study and other results [16] provided in this paper, it is necessary to organize a separate research into finding an impressionable prevention and therapeutic methods for this common disease. The lack of timely diagnosis and acceptance of the initiation of treatment in the early stage of retinopathy along side with small sample number of patients who were of two stage of retinopathy, were the limitations of this research.

5. CONCLUSION

After macular photocoagulation, there is an early improvement of the visual acuity (at 3-month follow-up) from the mean of 1.21 Log MAR to 0.83 Log MAR (P=0.02). This improvement fades with time and, at 12-months follow-up the visual acuity returns to pre-treatment levels to the mean of 1.27 Log MAR.

Early visual improvement after laser treatment in patients with diabetic retinopathy is followed to reduced impact of laser treatment in the long

term. So, this is emphasis to find long lasting treatment approach.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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